

**OPPORTUNITIES AND ECONOMIC PROSPECTS  
FOR RENEWABLE ENERGY GENERATION  
THROUGH ANAEROBIC TREATMENT  
OF MEAT PLANT WASTEWATER**

Presented at:  
**THE FUTURE OF RENEWABLE ENERGY GENERATION  
IN IOWA  
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**QUESTION 1:** How do you make energy from the greasy, bloody wastewater from a meat plant?

**ANSWER:** If the wastewater is held in the right anaerobic (without oxygen) conditions, the organic materials will first breakdown into acids and alcohols. Next those intermediate products will break down into methane (natural gas), carbon dioxide and trace amounts of other materials, including hydrogen sulfide (rotten egg gas). The combination of these gases is called “biogas”.

**QUESTION 2:** How does this biogas compare with natural gas?

**ANSWER:** Biogas from meat plants typically has about 75 % of the heating value of natural gas.

**QUESTION 3:** What do you do with the biogas?

**ANSWER:** It has typically been used in a boiler to produce steam for the meat plant. At one plant in Nebraska it is used to dry bone gelatin, while one plant in South Dakota used it in the early 1980s to run a Caterpillar engine to power one of their large aeration blowers at the wastewater treatment plant.

**QUESTION 4:** What does one of these anaerobic systems look like?

**ANSWER:** It varies, depending on the type of anaerobic system selected, but they often look like a lagoon with a heavy, black plastic cover over the top. Sometimes the black plastic cover will be partially inflated with biogas.

**QUESTION 5:** How well do these plastic covers stand up to Iowa weather?

**ANSWER:** One lagoon cover was installed in 1985 and was tested after about 8 years and showed no deterioration. That cover is still in place.

**QUESTION 6:** What is the potential for this renewable energy source?

**ANSWER:** See Table I showing existing meat plants in Iowa.

**TABLE 1****EXISTING MEAT PLANTS IN IOWA**

<u>CITY</u>	<u>PLANT NAME</u>	<u>PLANT TYPE</u>
1. Algona	Hormel	Meat Processing
2. Britt	Armour Swift-Eckrich	Meat Processing
3. Cherokee	Continental Deli	Meat Processing
4. Columbus Junction	IBP/Tyson	Pork Slaughter
5. Council Bluffs	IBP/Tyson	Meat Processing
6. Carroll	Farmland Foods	Meat Processing
7. Daveport	Oscar Mayer/Kraft	Meat Processing
8. Denison	American Protein	Rendering
9. Denison	Armour Swift-Eckrich	Meat Processing
10. Denison	Farmland Foods	Pork Slaughter
11. Denison	IBP/Tyson	Beef Slaughter
12. Des Moines	American Protein	Rendering
13. Des Moines	Iowa Packing Co.	Hog Slaughter
14. Des Moines	National By-Products	Rendering
15. Dubuque	Smithfield Foods/Farmland Foods	Meat Processing (currently closed)
16. Dubuque	????	Gelatin from Pork
17. Hawarden	Iowa Lamb Corp.	Lamb
18. Hospers	Packerland	Cow Slaughter
19. Independence	Iowa Ham Canning	Meat Processing
20. Knoxville	Hormel	Meat Processing
21. Marshalltown	Swift and Co.	Pork Slaughter
22. Mason City	Armour Swift-Eckrich	Meat Processing
23. Nevada	Burke Corp.	Pizza Topping
24. Oakland	OSI	Meat Processing
25. Orange City	Excel Specialty	Meat Processing
26. Osceola	Osceola Foods	Meat Processing
27. Ottumwa	Excel Corp.	Pork Slaughter
28. Perry	IBP/Tyson	Pork Slaughter
29. Schleswig	Schleswig Specialty	Meat Processing
30. Port Neal Landing	K&K Gelatin	Gelatin from Pork
31. Sioux Center	Sioux-Preme Packing	Hog Slaughter
32. Sioux Center	Tyson	Meat Processing
33. Sioux City	John Morrell	Hog Slaughter
34. Sioux City	Darling International	Rendering
35. Storm Lake	IBP/Tyson	Hog Slaughter
36. Storm Lake	Bil Mar Foods	Turkey Slaughter
37. Waterloo	IBP/Tyson	Hog Slaughter
<b>38.</b> West Liberty	Louis Rich	Turkey Slaughter

**QUESTION 7:** How much biogas could these plants produce?

**ANSWER:** Many of the slaughter plants could generate biogas containing about 2,675,000 cubic feet/wk of natural gas. The other plants could probably only produce about 500,000 cubic feet/wk of natural gas.

If all the plants were to treat their wastewater anaerobically and recover biogas, they would generate about 2,570 million cubic feet of natural gas per year. At \$0.40/therm (\$4/1000 cubic feet), this would amount to over \$10 million dollars/yr.

**QUESTION 8:** Do any of these plants already use anaerobic treatment?

**ANSWER:** See Table II for a list of Iowa meat plants employing anaerobic treatment.

**TABLE II**  
**IOWA MEAT PLANTS WITH ANAEROBIC TREATMENT**

<u>CITY</u>	<u>PLANT NAME</u>	<u>PLANT TYPE</u>
1. Britt	Armour Swift-Eckrich	Meat Processing
2. Cherokee	Continental Deli	Meat Processing
3. Columbus Junction	IBP/Tyson	Pork Slaughter
4. Denison	Farmland Foods	Pork Slaughter
5. Denison	IBP/Tyson	Beef Slaughter
6. Dubuque	Smithfield Foods/Farmland Foods (closed)	Meat Processing
7. Hospers	Packerland	Cow Slaughter
8. Marshalltown	Swift and Co.	Pork Slaughter
9. Oakland	OSI	Meat Processing
10. Ottumwa	Excel Corp.	Pork Slaughter
11. Sioux Center	Sioux-Preme Packing	Hog Slaughter
12. Storm Lake	IBP/Tyson	Hog Slaughter
13. Waterloo	IBP/Tyson	Hog Slaughter

## POINTS FOR CONSIDERATION

- 1. 34% of all Iowa meat plants already use anaerobic treatment.**
- 2. 64% of all slaughter plants, which have the greatest waste loads, use anaerobic treatment.**
- 3. Any time anaerobic treatment is used, energy is also saved by not having to power nearly as much mechanical aeration equipment in the next treatment step after anaerobic treatment**

**QUESTION 9:** Why don't more plants use anaerobic treatment?

**ANSWER:** For a variety of reasons:

- a) Some plants are located in towns and cities where land is not available or where construction of anaerobic wastewater treatment facilities is inappropriate.**
- b) The smaller meat processing plants often rely on municipal wastewater treatment and don't want to be in the business of wastewater treatment.**
- c) Sometimes the water supply is so high in sulfates that the biogas would contain excess amounts of hydrogen sulfide. (Sulfates in the water supply are the prime source of the hydrogen sulfide in the biogas.)**
- d) Other....**

**QUESTION 10:** Do all of the plants in Table II capture the biogas?

**ANSWER:** No, only those plants shown in Table III capture the biogas emitted from the anaerobic treatment.

**TABLE III  
IOWA MEAT PLANTS WITH BIOGAS RECOVERY  
FROM ANAEROBIC TREATMENT**

<u>CITY</u>	<u>PLANT NAME</u>	<u>PLANT TYPE</u>
1. Dubuque	Smithfield Foods/Farmland Foods (closed)	Meat Processing
2. Hospers	Packerland	Cow Slaughter
3. Marshalltown	Swift and Co.	Pork Slaughter
4. Ottumwa	Excel Corp.	Pork Slaughter
5. Storm Lake	IBP/Tyson	Hog Slaughter
6. Waterloo	IBP/Tyson	Hog Slaughter

**POINTS FOR CONSIDERATION**

- 1. 15% of all Iowa meat plants recover biogas from anaerobic treatment.**
- 2. 43% of all Iowa slaughter plants recover biogas from anaerobic treatment.**
- 3. If biogas is not captured, it can be a source of odors from the trace amounts of hydrogen sulfide and other odorous compounds it contains.**

**QUESTION 11:** Why don't more plants capture the biogas?

**ANSWER:** For a variety of reasons; some of these are as follows:

- a) Covers are expensive – often around \$3.25 per square foot for high-quality covers.
- b) If high in hydrogen sulfide, burning the biogas could cause air emissions problems with SO<sub>x</sub>.
- c) Other...

**QUESTION 12:** Why then do some plants capture the biogas?

**ANSWER:** The sole reason for the plants in Table III capturing the biogas was for odor control. Added benefits from covering anaerobic systems are to reduce heat loss from the wastewater in these systems and the potential to utilize the biogas.

**QUESTION 13:** Do all of the plants in Table III utilize the biogas?

**ANSWER:** Of the six plants that recover biogas from anaerobic treatment, four flare it and only two plants utilize it: Swift – Marshalltown and Smithfield Foods/Farmland Foods – Dubuque, but the Dubuque plant is currently closed.

**QUESTION 14:** Why don't more of these plants utilize the biogas?

**ANSWER:** For a variety of reasons, some of these are as follows:

- a) There may be no readily-available way to use it other than engine-driven generators, which are expensive and maintenance-intensive (Packerland - Hospers & IBP – Storm Lake)
- b) The City owns the covered anaerobic lagoons (Packerland – Hospers & IBP – Waterloo)
- c) Other reasons....

**QUESTION 15:** What are the major impediments to meat plants generating, capturing and utilizing biogas?

**ANSWER:** Several, as follows:

- a) POOR PAYBACK – meat companies require a two-year simple payback period. The addition of covers, biogas safety and handling equipment, and boiler modifications to existing anaerobic lagoons generally results in a simple payback period greater than four years.
- b) SO<sub>x</sub> limits on biogas utilization boilers.
- c) “Strings” attached to governmental incentive programs
- d) Other...